

Identification of single and multiple disease resistance in desi chickpea genotypes to *Ascochyta* blight, *Botrytis* gray mold and *Fusarium* wilt

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Chickpea (*Cicer arietinum*) is the third most important food legume grown on 11 million ha with 7.1 million t production in over 45 countries of the world. The crop significantly contributes to human nutrition through high quality protein, soil fertility through biological nitrogen fixation and diversification of cereal-based cropping systems through water use efficiency. Chickpea productivity is limited by several diseases, of which *Ascochyta* blight (AB) caused by *Ascochyta rabiei*, *Botrytis* gray mold (BGM) caused by *Botrytis cinerea* and *Fusarium* wilt (FW) caused by *Fusarium oxysporum* f sp *ciceris* are predominant. These diseases can be managed by seed dressing and foliar application of fungicides. However, fungicidal management of AB and BGM is unsustainable, uneconomical and hazardous to environment. Host plant resistance is most effective either alone or as a major component of integrated disease management. In this article, we report the identification of resistance in the recently developed 117 desi chickpea genotypes at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India to AB/BGM diseases using the controlled environment screening technique (CEST) and to FW using the field environment screening technique (FEST).

For CEST, two sets of chickpea genotypes were raised, one each for AB and BGM resistance evaluation separately. In each tray nine test genotypes along with a susceptible check, Pb 7 for AB and JG 62 for BGM, were sown in rows (8 seeds/row). Seed were sown in 40 cm × 30 cm × 5 cm plastic trays filled with sand and vermiculite mixture (10:1) and kept in greenhouse at 25±1°C and 12 h photoperiod. For AB resistance evaluation 12-day-old seedlings were spray inoculated with conidial suspension (5×10^4 conidia ml⁻¹) of a virulent isolate of *A. rabiei* from Hisar, India. The inoculated seedlings were

incubated in growth room at 20±1°C with ~1500 lux light intensity for 12 h a day. For the first 96 h of inoculation, 100% relative humidity (RH) was maintained followed by 6 h for 10 days (Haware et al. 1995, Pande et al. 2005). For BGM evaluation, another set of chickpea genotypes was inoculated (3×10^5 conidia ml⁻¹) with a virulent isolate of *B. cinerea* from Pantnagar, India. Inoculated seedlings were incubated at 15±1°C and 100% RH with ~1500 lux light intensity for 12 h a day (Pande et al. 2006). Severities of AB and BGM were recorded on a 1–9 rating scale 10 days after inoculation. Based on the disease rating, individual entries were categorized as asymptomatic (score 1.0), resistant (score 1.1 to 3.0), moderately resistant (score 3.1 to 5.0), susceptible (score 5.1 to 7.0) and highly susceptible (score 7.1 to 9.0).

Fusarium wilt evaluation was conducted following FEST. Test lines (117) were planted in 5 m long rows at 40 cm apart in wilt sick plot at ICRISAT, Patancheru using a randomized block design with two replications. A susceptible check, JG 62 (ICC 4951), was planted after every two rows of genotypes. Wilt incidence was recorded at 10-day intervals starting from 30 days after sowing till grain maturity and harvest (Haware et al. 1992).

On the basis of AB and BGM severity scores, and FW incidence till harvest, the chickpea genotypes were grouped into different resistance classes. Of the 117 genotypes evaluated, 14 showed high levels of resistance (<3 on 1–9 rating scale) and 90 moderate levels of resistance to AB. None of the genotypes had high levels of resistance to BGM; however, amongst 48 moderately resistant genotypes, ICCV 05530 had less than 4 rating. In FW resistance screening, three genotypes (ICCV 05526, ICCV 05530, ICCV 05533) were asymptomatic, 11 resistant and 4 moderately resistant until harvest time to FW (Table 1).

Table 1. Reaction of desi chickpea lines to Ascochyta blight (AB), Botrytis gray mold (BGM) and Fusarium wilt (FW)¹.

Disease	Asymptomatic	Resistant	Moderately resistant
AB ²	–	14 ICCVs 04518, 04523, 04524, 04525, 04526, 04530, 04537, 05543, 05546, 05562, 05563, 05564, 05565, 05571	90 ICCVs 04052, 04503, 04504, 04505, 04506, 04509, 04510, 04511, 04512, 04513, 04514, 04515, 04517, 04519, 04520, 04521, 04522, 04527, 04528, 04529, 04531, 04532, 04533, 04534, 04535, 04536, 05501, 05502, 05503, 05504, 05505, 05506, 05507, 05508, 05509, 05510, 05511, 05512, 05513, 05514, 05515, 05516, 05517, 05518, 05519, 05520, 05521, 05522, 05523, 05525, 05526, 05527, 05528, 05529, 05530, 05531, 05532, 05533, 05534, 05535, 05536, 05537, 05538, 05539, 05540, 05541, 05542, 05544, 05547, 05548, 05549, 05550, 05551, 05552, 05553, 05554, 05555, 05556, 05557, 05558, 05559, 05560, 05561, 05566, 05567, 05568, 05569, 05570, 05572, 05573
BGM ²	–	–	48 ICCVs 04052, 04503, 04506, 04509, 04510, 04512, 04513, 04514, 04515, 04601, 04602, 04607, 04608, 04609, 05501, 05502, 05505, 05506, 05508, 05509, 05510, 05516, 05520, 05521, 05522, 05524, 05525, 05526, 05527, 05528, 05529, 05530, 05531, 05532, 05533, 05535, 05543, 05546, 05547, 05553, 05555, 05560, 05565, 05566, 05571, 05572, 05573, 05603
FW ³	3 ICCVs 05526, 05530, 05533	11 ICCVs 04512, 04513, 05507, 05523, 05525, 05527, 05528, 05529, 05531, 05532, 05534	4 ICCVs 04514, 04534, 05508, 05522
AB+BGM	–	–	41 ICCVs 04052, 04503, 04506, 04509, 04510, 04512, 04513, 04514, 04515, 05501, 05502, 05505, 05506, 05508, 05509, 05510, 05516, 05520, 05521, 05522, 05525, 05526, 05527, 05528, 05529, 05530, 05531, 05532, 05533, 05535, 05543, 05546, 05547, 05553, 05555, 05560, 05565, 05566, 05571, 05572, 05573
AB+FW	–	–	18 ICCVs 04512, 04513, 04514, 04534, 05507, 05508, 05522, 05523, 05525, 05526, 05527, 05528, 05529, 05530, 05531, 05532, 05533, 05534
BGM+FW	–	–	14 ICCVs 04512, 04513, 04514, 05508, 05522, 05525, 05526, 05527, 05528, 05529, 05530, 05531, 05532, 05533
AB+BGM+FW	–	–	14 ICCVs 04512, 04513, 04514, 05508, 05522, 05525, 05526, 05527, 05528, 05529, 05530, 05531, 05532, 05533

1. Figures in bold indicate number of genotypes.

2. Asymptomatic: disease score 1.0; Resistant: disease score 1.1 to 3.0; Moderately resistant: disease score 3.1 to 5.0 on a 1 to 9 rating scale.

3. Asymptomatic: 0% mortality; Resistant: 1 to 10% mortality; Moderately resistant: 11–20% mortality; Susceptible: 21–50% mortality; Highly susceptible: >50% mortality.

Further, multiple disease resistance to more than one of the three diseases (AB, BGM and FW) was identified in several genotypes. Among the 117 genotypes, 14 were moderately resistant to three diseases, while 41, 18 and 14 genotypes had moderate levels of resistance to AB+BGM, AB+FW and BGM+FW, respectively (Table 1). Identification of resistance against individual and select combinations of two or more diseases would permit use of these genotypes in improving disease resistance in desi chickpea.

References

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